GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (ADVANCE MANUFACTURING SYSTEM) (50)

CAD CAM SYSTEMS

SUBJECT CODE: 2715002

SEMESTER: I

Type of course: Engineering Science

Prerequisite: The prerequisites of this subject is basic knowledge and understanding of engineering graphics, engineering drawing & mechanical engineering drawing and conversance with some CAD software and its application

Rationale: The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time. To satisfy this need the use of CAD/CAM technology and tools is inevitable. With this intention this subject is introduced in the curriculum**.**

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Fundamental of CAD:** Introduction, Reasons for implementing a CAD system, conventional design v/s CAD, Benefits, Hardware, CAD software, Technical specification of CAD workstation, computer software	4	10
2	**Computer graphics:** Scan conversion, Bresenham's Algorithm, Geometric transformations, 2D and 3D translation, scaling, rotation, shear and reflection, homogeneous transformations	8	15
3	**Geometric modeling:** Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves Hermit cubic splines Bezier curves, B-splines rational curves. Representations: B-rep and C-rep, Feature based modeling	8	20
4	**Surface modeling:** Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.	8	20
5	**Geometric modelling-3D:** Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).	6	15
6	**Computer Aided Manufacturing:** Principles of optimum design –	8	20

	CAD optimization techniques, Application of CAD – computer-aided process planning – post processing – NC code generation – principles of computer aided engineering and concurrent engineering		

Reference Books:

1. CAD/CAM, Theory and practice, Ibrahim Zeid & R. Sivasubramanian, Tata Mc Graw Hill international
2. CAD/CAM, Computer Aided design and Manufacturing , Mikell Groover and Zimmer, Pearson Education
3. Mathematical elements for computer graphics, David F. Rogers & J. Alan Adams, McGraw Hill
4. Finite Element Analysis, Chendraupatla, EEE Publication.
5. Computer Graphics & design, P. Radhakrishnan & C.P. Kothanadaraman, New age publication
6. Geometric Modelling, Mortenson, M.E., John Wiley & Sons, NY, 1985

Course Outcome:

1. Understand the role of CAD/CAM in modern design and manufacturing
2. Describe the principles of Computer Aided Designing systems and the concepts of Geometric modeling, solid modeling, and feature-based design modeling.
3. Create and design mechanical parts and elements in 2D and 3D dimension using state of the art CAD System.
4. Use state of the art CAD/CAM systems to develop CNC part programs for a series of mechanical parts.
5. Experience actual machining of simple and complex mechanical parts using CNC trainer and production machine

List of Experiments:

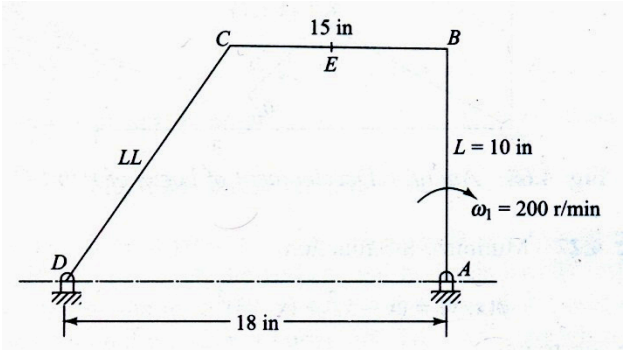
1. Create manually G-code CNC programs, simulate the tool-path.
2. Create the drawing of a mechanical part using state of the art CAD/CAM system.
3. Generate the G-code using the CAM system and the embedded post-processor.
4. Operate a CNC milling machine. Load a G-code program and execute actual machining
5. Operate a CNC turning machine. Load a G-code program and execute actual machining

Open ended problems:

1. Design and model the components of a lathe machine.
2. A four-bar mechanism is shown. The input angular velocity of the link AB is 200 r/min clockwise. Point E, the center of the link CB, is connected to a valve that is not shown in figure. The mechanism is to be redesigned such that:

   Design criterion: the maximum linear velocity of point E must be greater than its current value by at least 5 inch/s.

   Design constraints: (1) only L and LL length can change and (2) AB must rotate full 360^{o}.



3. Choose a mechanical element such as a gear and generate its geometric model.
4. Create a solid model of your choice in a CAD system. Transfer it to a CAM software and generate NC program from it.
5. Figure shows a duct of an air-conditioning system. The 4-inch diameter pipe is connected to a 4-inch diameter elbow. The elbow is joined to a truncated cone having a 4-inch diameter and 6-inch diameter ends. The 6-inch diameter end is increased to a 10 X 10 inch square end. If the thickness of duct is ignored find duct cross section at the valve location using surface model of the duct.